# FOLDABLE BICYCLE

## BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a bicycle, and more particularly to a foldable bicycle to save space when storing or transporting the bicycle.

2. Description of Related Art

Bicycles are more and more popular in recent years because of their convenience and ability to provide exercise for a rider. A conventional bicycle substantially comprises a frame, a fork, a front wheel, a stem, a handlebar, a seat, a rear fork, a rear wheel and a drive assembly to rotate the rear wheel. Because a conventional bicycle's structure is well known, a detailed description of the conventional bicycle is omitted. However, the conventional bicycle has a large volume, and a bumper or car-top rack is often used to transport conventional bicycles, so foldable bicycles are provided to solve the problem.

The conventional foldable bicycle has a folding device incorporated into the frame to make the bicycle foldable so less space is required for storing or transporting the bicycle. However, the conventional folding device has a complex structure and complicates the structure of the foldable bicycle. The conventional folding device makes a bicycle with a shock absorber especially complicated and increases the cost of manufacturing the foldable bicycle.

To overcome the shortcomings, the present invention provides a foldable bicycle to mitigate or obviate the aforementioned problems.

## SUMMARY OF THE INVENTION

The main objective of the invention is to provide a foldable bicycle that

has a simplified structure and can be folded to a minimum volume. The foldable bicycle has a frame, a front fork, a front wheel, a stem, a handlebar, a handlebar positioning device, a seat post, a seat, a rear fork, a rear wheel, a drive assembly, a shock absorber and a rear fork positioning device. The handlebar positioning device is mounted between the front fork and the stem to allow the stem to be folded relative to the frame. The rear fork positioning device is mounted between the shock absorber and the rear fork to allow the rear fork to be folded relative to the frame. With such a structure, the bicycle is foldable to reduce the space for storing or transporting the bicycle, and the structure of the foldable bicycle with a shock absorber is simplified.

Other objectives, advantages and novel features of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a side plan view of a foldable bicycle in accordance with the present invention;

Fig. 2 is an exploded perspective view of a handlebar positioning device on the foldable bicycle in Fig. 1;

Fig. 3 is an enlarged side plan view in partial section of the handlebar positioning device in Fig. 2;

Fig. 4 is an operational side plan view in partial section of the handlebar positioning device in Fig. 3;

Fig. 5 is an enlarged perspective view of a rear fork positioning device on the foldable bicycle in Fig. 1;

Fig. 6 is an enlarged perspective view of a seat, seat post and seat tube on the foldable bicycle in Fig. 1;

Fig. 7 is a side plan view of the foldable bicycle in Fig. 1 with the bicycle folded;

Fig. 8 is an enlarged side plan view in partial section of a seat positioning device mounted between the seat post and the seat tube in the foldable bicycle in Fig. 1; and

Fig. 9 is an enlarged side plan view of the front fork and the front wheel on the foldable bicycle in Fig. 1.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

With reference to Fig. 1, a foldable bicycle in accordance with the present invention comprises a frame (10), a front fork (12), a front wheel (13), a stem (14), a handlebar (15), a handlebar positioning device (20), a rear fork (18), a rear wheel (19), a drive assembly (not numbered), a shock absorber (30), a rear fork positioning device (40), a seat post (17) and a seat (172). The frame (10) has a front end (not numbered), a rear end (not numbered), a head tube (11) and a seat tube (16). The head tube (11) is formed on the front end, and the seat tube (16) formed on the rear end.

The front fork (12) has a top end (not numbered), a bottom end (not numbered), a neck (not shown) and two parallel tines (not numbered). The neck has a top end (not numbered) and a bottom end (not numbered), is formed at the top end of the front fork (12) and is mounted rotatably through the head tube (11). The tines respectively have a top end (not numbered) and a bottom end (not numbered) and are formed at the bottom end of the front fork (12) with the top

ends connected to the bottom end of the neck.

The front wheel (13) is rotatably mounted at the bottom end of the front fork (12) between the bottom ends of the tines with a front axle (not numbered). With further reference to Fig. 9, a transverse slot (122) having an upper edge (not numbered) and a lower edge (not numbered) is defined through the distal end of each tine of the front fork (12). The front axle extends through the slot (122). Multiple recesses (124) are defined in the upper edge of the transverse slot (122) to selectively mount the front axle. Consequently, the front wheel (13) can be positioned relative to the front fork (12) at different positions to adjust to different riders.

The stem (14) is connected pivotally to the top of the front fork (12) by the handlebar positioning device (20) and has a top (not numbered) and a bottom (not numbered). The handlebar (15) is transversely mounted near the top of the stem (14).

With further reference to Figs. 2 and 3, the handlebar positioning device (20) comprises a bracket (21), a locking pin (22), a locking neck (24) and a handlebar quick-release device (26). The bracket (21) is attached to the top of the front fork (12), holds the front fork (12) in the head tube (11) and has an axial through hole (not numbered), a front longitudinal protrusion (not numbered) and a rear longitudinal protrusion (not numbered). The front longitudinal protrusion has a longitudinal slot (212) and two wings (not numbered). The wings are formed on opposite sides of the longitudinal slot (212) and extend away from the frame (10). The locking pin (22) is mounted in the longitudinal slot (212) between the wings.

The locking neck (24) protrudes from the bottom of the stem (14) and is mounted in the longitudinal slot (212) in the bracket (21). The locking neck (24) has a distal end with a transverse notch (242) corresponding to the locking pin (22) and an longitudinally elongated transverse through hole (244) longitudinally defined through the locking neck (24).

The handlebar quick-release device (26) is mounted on the bracket (21) to squeeze and hold the locking neck (24) between the wings protruding from the bracket (21) and has a compression pin (262), a compression washer (264) and a compression lever (266). The compression pin (262) extends through the wings and the longitudinally elongated transverse through hole (244) in the locking neck (24) and has a threaded distal end (not numbered). The compression washer (264) is mounted around the compression pin (262) near the thread distal end and abuts one of the wings of the bracket (21). The compression lever (266) has a proximal end (not numbered), a distal end (not numbered), an eccentric cam (not numbered) and a rotatable pin (not numbered). The eccentric cam is formed on the distal end and has a transverse through hole (not numbered). The pin is rotatably mounted in the transverse through hole and has a threaded transverse through hole (not numbered). The threaded distal end of the compression pin (262) is screwed into the threaded transverse through hole in the pin, and the eccentric cam abuts the compression washer (264). When the compression lever (266) is rotated and the eccentric cam presses against the compression washer (264), the wings are squeezed together and clamp the locking neck (24). Consequently, the stem (14) will be held securely in place relative to the front fork (12).

With reference to Figs. 1, 4 and 7, when the compression lever (266) is pivoted to a position where the eccentric cam does not abut the compression washer (264), the wings previously clamping the locking neck (24) will be released. The stem (14) and the locking neck (24) can be moved upward along the longitudinally elongated transverse through hole (244) relative to the longitudinal slot (212) in the bracket (21), and the transverse notch (242) will be released from the locking pin (22). The front fork (12) is rotated in the head tube (11) until the longitudinal slot (212) in the bracket (21) faces the frame (10). Then, the stem (14) can be pivoted relative to the bracket (21) at the compression pin (262) toward the frame (10). Accordingly, the bicycle stem (14) and handlebar (15) are folded to reduce the space required for storing or transporting the bicycle.

In an alternative embodiment, the longitudinal slot (212) is defined in the bracket (21) faces the frame (10). With such an arrangement, the stem (14) can be folded toward the frame (10) without rotating the front fork (12).

With reference to Figs. 1 and 5, the rear fork (18) is pivotally attached to the frame (10) and has a proximal end (not numbered) and a distal end (not numbered). The proximal end (not numbered) of the rear fork (18) is pivotally attached to the frame (10), and the rear wheel (19) is rotatably mounted on the distal end of the rear fork (18). The drive assembly is mounted between the rear fork (18) and the rear wheel (19) to rotate the rear wheel (19). The drive assembly substantially comprises two pedal assemblies (not numbered), a front sprocket (not numbered), a rear sprocket (not numbered) and a chain (not numbered). The drive assembly is conventional and is not further described.

The shock absorber (30) is mounted between the frame (10) and the rear fork (18) and has a proximal end (not numbered) pivotally attached to the frame (10) and a distal end (not numbered) connected to the rear fork (18) with the rear fork positioning device (40). The rear fork positioning device (40) comprises a U-shaped bracket (42) and a shock absorber quick-release device (44). The U-shaped bracket (42) is securely attached to the rear fork (18) and has two sides (not numbered), two through holes (not shown) and two slots (422). The distal end of the shock absorber (30) is mounted between the two sides of the bracket (42). The through holes are defined respectively in the sides of the bracket (42). The slots (422) are defined respectively in the sides of the bracket (42) and communicate with the through holes.

The shock absorber quick-release device (44) is mounted on the bracket (42) to selectively connect the distal end of the shock absorber (30) to the bracket (42). The shock absorber quick-release device (44) has a structure and operates the same as the handlebar quick-release device (26) and has a compression pin (not numbered), a compression washer (not numbered) and a compression lever (not numbered). The compression pin extends through the through holes in the sides of the bracket (42) and the distal end of the shock absorber (30) and has a threaded distal end (not numbered). The compression washer is mounted around the compression pin near the threaded distal end and abuts one of the sides of the bracket (42). The compression lever has a proximal end (not numbered), a distal end (not numbered), an eccentric cam (not numbered) and a rotatable pin (not numbered). The eccentric cam is formed on the distal end and has a transverse through hole (not numbered). The pin is rotatably mounted in the transverse

through hole and has a threaded transverse through hole (not numbered). The threaded distal end of the compression pin is screwed into the threaded transverse through hole in the pin, and the eccentric cam abuts the compression washer.

When the compression lever is rotated and the eccentric cam presses against the compression washer, the sides of the bracket (42) are squeezed together and clamp the distal end of the shock absorber (30). Consequently, the distal end of the shock absorber (30) will be securely connected to the rear fork (18).

With further reference to Fig. 7, when the compression lever is pivoted to a position where the eccentric cam does not abut the compression washer, the sides of the bracket (42) previously clamping the distal end of the shock absorber (30) will be released. The proximal end of the shock absorber (30) can be pivoted toward the frame (10) after the compression pin in the shock absorber quick-release device (44) is removed from the slots (422) in the sides of the bracket (42). With the shock absorber (30) pivoted close to the frame (10), the rear fork (18) and the rear wheel (19) with the drive assembly can be pivoted toward the frame (10). Accordingly, the rear fork of the bicycle can be folded to further reduce the space for storing or transporting the bicycle.

With reference to Figs. 1 and 6, the seat post (17) extends through and is detachable mounted in the seat tube (16) and has a top (not numbered). The seat (172) is mounted on the top of the seat post (17). To selectively mount the seat post (17) in the seat tube (16), the seat tube (16) has a top (not numbered), a slit (162), two ears (164) and a seat quick-release device (50). The slit (162) has two

sides longitudinally defined in the top of the seat tube (16). The two ears (164) are formed at the top of the seat tube (16) and respectively at the two sides of the slit (162). The seat quick-release device (50) is mounted on the seat tube (16) to securely hold the seat post (17) in the seat tube (16). The seat quick-release device (50) has a structure and operates the same as the handlebar and shock absorber quick-release devices (26, 44) and comprises a compression pin (not numbered), a compression washer (not numbered) and a compression lever (not numbered). The compression pin extends through the ears (164) on the seat tube (16) and has a threaded distal end (not numbered). The compression washer is mounted around the compression pin near the threaded distal end and abuts one of the ears (164) on the seat tube (16). The compression lever has a proximal end (not numbered), a distal end (not numbered), an eccentric cam (not numbered) and a rotatable pin (not numbered). The eccentric cam is formed on the distal end and has a transverse through hole (not numbered). The pin is rotatably mounted in the transverse through hole and has a threaded transverse through hole (not numbered). The threaded distal end of the compression pin is screwed into the threaded transverse through hole in the pin, and the eccentric cam abuts the compression washer.

When the compression lever is rotated and the eccentric cam presses against the compression washer, the ears (164) on the seat tube (16) are squeezed together to narrow the slit (162) and clamp the seat post (17). Consequently, the seat post (17)will be securely held in the seat tube (16) at a desired height.

With further reference to Fig. 7, when the compression lever is pivoted to a position where the eccentric cam does not abut the compression washer, the

ears (164) on the seat tube (16) will be released, and the seat post (17) will be released. The seat post (17) with the seat (172) can be removed from the seat tube (16) to allow the stem (14) to fold closer to the frame (10) to further reduce the volume of the folded bicycle.

With such folding features, the structure of a bicycle with a shock absorber (30) is simplified, and the cost for manufacturing a foldable bicycle will be reduced.

With reference to Figs. 1 and 8, an optional embodiment of the seat tube (16) and seat post (17) has multiple positioning holes (not numbered) defined longitudinally through the seat tube (16) and a single through hole (not numbered) defined through the seat post (17). The single through hole in the seat post (17) selectively corresponds to any one of the positioning holes in the seat tube (16). A lock (166) is mounted inside the seat post (17), is a resilient U-shaped element and has an end (not numbered) with a knob (not numbered) extending through the bore in the seat post (17) and into a corresponding positioning hole in the seat tube (16). When the knob on the lock (166) is seated in a through hole in the seat tube (16), the seat post (17) will be held at a desired vertical position and be kept from rotating in the seat tube (16).

Even though numerous characteristics and advantages of the present invention have been set forth in the foregoing description, together with details of the structure and function of the invention, the disclosure is illustrative only, and changes may be made in detail, especially in matters of shape, size, and arrangement of parts within the principles of the invention to the full extent indicated by the broad general meaning of the terms in which the appended

claims are expressed.